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DOI: https://doi.org/10.1159/000431290

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Journal Article
Published Version

Originally published at:
Weidt, Steffi; Klaghofer, Richard; Kuenburg, Alexa; Bruehl, Annette Beatrix; Delsignore, Aba; Moritz, Steffen; Rufer, Michael (2015). Internet-based self-help for trichotillomania: A randomized controlled study comparing decoupling and progressive muscle relaxation. Psychotherapy and Psychosomatics, 84(6):359-367.
DOI: https://doi.org/10.1159/000431290

Regular Article

Psychotherapy and Psychosomatics

Psychother Psychosom 2015;84:359–367
DOI: 10.1159/000431290

Received: January 6, 2015
Accepted after revision: May 10, 2015
Published online: September 24, 2015

Internet-Based Self-Help for Trichotillomania: A Randomized Controlled Study Comparing Decoupling and Progressive Muscle Relaxation

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Key Words
Trichotillomania · Self-help · Online intervention · Decoupling · Progressive muscle relaxation

Abstract
Background: Trichotillomania (TTM) is characterized by recurrent hair-pulling that results in substantial hair loss. A previous pilot study demonstrated that the online self-help intervention 'decoupling' (DC) might be effective at reducing hair-pulling symptoms, with a stronger effect than progressive muscle relaxation (PMR). We aimed to extend these findings using a more robust randomized clinical trial design, including diagnostic interviews by phone, a 6-month follow-up and e-mail support. ***Methods:*** One hundred five adults with TTM were recruited online and randomly allocated to either DC (n = 55) or PMR (n = 50). The intervention lasted 4 weeks, with severity of TTM assessed at 3 time points (before intervention, immediately after intervention and at the 6-month follow-up) using the Massachusetts General Hospital Hair-Pulling Scale (MGH-HPS). Both intention-to-treat and completer analyses were conducted. ***Results:*** Intention-to-treat analysis demonstrated highly significant and comparable symptom reductions (MGH-HPS) in both the DC and PMR groups ($p < 0.001$, partial $\eta^2 = 0.31$) that persisted through 6 months of follow-up. Participants' subjective appraisals favoured DC in some areas (e.g. greater satisfaction with DC than PMR). Completer analyses demonstrated the same pattern as the intention-to-treat analyses. ***Conclusions:*** Despite subjective appraisals in favour of DC, symptom reduction was comparable in the two groups. While the results suggest that even short Internet-based interventions like DC and PMR potentially help individuals with TTM, a partial effect of unspecific factors, like regression towards the mean, cannot be ruled out. Therefore, longitudinal studies with non-treated controls are warranted.

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Introduction

Trichotillomania (TTM) is characterized by the recurrent and irresistible urge to pull out one's own hair, resulting in noticeable hair loss and causing substantial distress and impairment [1]. The lifetime prevalence of TTM in males and females is roughly 0.6–1% [2, 3], while in clinical settings TTM is found more frequently in women [4–6]. Clinically relevant subtypes of hair-pulling behaviour include focused hair-pulling and automatic hair-pulling [7, 8]. *Focused pulling* is regarded as intentional

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0033–3190/15/0846–0359$39.50/0

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and goal-directed, whereas unfocused *automatic pulling* is considered unintentional and not goal-directed [9, 10]. Most patients report both: automatic and focused pulling [11].

Cognitive-behavioural therapy, including habit reversal training (HRT) [12], is considered the first-line treatment for both hair-pulling subtypes [4]. The effectiveness of HRT treatment has been confirmed [for an overview, see 4]. Moreover, HRT has been reported to be superior to pharmacological approaches like selective serotonin reuptake inhibitors and clomipramine [13]. HRT includes awareness training, self-monitoring, stimulus control and competing-response training, like substituting the misbehaviour with some (freezing) alternative behaviour [4]. Other components, like relaxation training (e.g. progressive muscle relaxation, PMR), have subsequently been added to HRT [14].

Although various treatment options are available, affected individuals often avoid treatment for several years [11, 15]. TTM is therefore considered one of the 'hidden disorders' [16]. Untreated, TTM is likely to cause relevant functional impairment and a markedly decreased quality of life [4, 11, 17, 18]. Online self-help behavioural interventions have been demonstrated to be efficient at reaching and helping patients with different psychiatric symptoms (e.g. anxiety and depression [19–23]). Therefore, to reach hidden TTM patients earlier, Moritz and Rufer [24] have developed a novel, Internet-delivered self-help intervention called *decoupling* (DC).

DC is a comprehensive treatment concept that encompasses different treatment strategies: (1) illustrated psycho-educational information about TTM; (2) self-monitoring of symptoms and triggers of hair-pulling; (3) explanations about 'overriding' the dysfunctional movement programme, and (4) instructions on how to 'decouple' the urge to pull from actual hair-pulling. This is intended not only to override new hair-pulling impulses by creating a conflict between two motor programmes, but also to strengthen self-awareness of hair-pulling [24].

The feasibility and effectiveness of DC as an Internet-delivered self-help intervention have already been assessed in an initial online pilot study with 42 subjects undergoing a 4-week DC or PMR intervention. Pre-post analyses demonstrated that hair-pulling symptoms decreased to a significantly greater extent in the DC than PMR group [24]. Another study also highlighted the potential of DC to reduce nail-biting, again against an active control [25]. However, the generalizability of the results on hair-pulling symptoms is limited by certain methodological issues (e.g. the lack of expert ratings and follow-up data). Furthermore, psycho-educational information on TTM was only included in the DC manual, which might have inflated group differences. To counter these limitations, we have now improved the study design substantially by: (1) including telephone expert ratings of TTM symptoms and comorbid conditions; (2) providing psycho-educational information on TTM in both the DC and PMR manuals, and (3) adding a 6-month follow-up assessment to test for long-term effects. Finally, (4) as there is growing evidence that Internet interventions with additional e-mail support demonstrate better results than unsupported interventions [21, 26–28], we provided both the DC and PMR groups with standardized e-mail support. Again, treatments were administered and outcome data collected and analysed within the context of a randomized, blinded clinical trial.

Our a priori hypotheses were: (1) that the decrease in hair-pulling would be greater in the DC than in the PMR group, and (2) that the reduction in hair-pulling would persist through 6 months of follow-up.

Materials and Methods

This double-blind randomized controlled trial (NCT02044237) was conducted online. The study was approved by the local ethics committee of the Canton of Zurich in Switzerland. It was conducted in full accordance with the Declaration of Helsinki, with all subjects providing their electronic informed consent prior to participation. There were no changes to the trial design after its commencement. A multipronged approach included several recruitment strategies, as suggested for Internet studies [29, 30]: announcements on trichotillomania disorder websites, postings in online self-help forums and notices in trichotillomania chat rooms [for details, see 31].

Participants

A total of 141 individuals signed the electronic informed consent form and entered the survey.

After finishing the presurvey (the online questionnaire, programmed using QuestBack Unipark), potentially eligible individuals were contacted for a telephone interview. To be included in the study, individuals had to meet diagnostic criteria for TTM, as per DSM-IV-TR classification criteria [32]. Exclusion criteria were current suicidal ideations, dependency on alcohol or drugs, or a current psychotic episode.

Individuals were not included if they discontinued the survey or declined to participate (n = 28), did not meet diagnostic criteria for TTM (n = 3) or met exclusion criteria (n = 5). After the telephone interview, a total of 105 participants were randomly assigned to either the DC (n = 55) or PMR (n = 50) group (CONSORT chart diagram, fig. 1). After 4 weeks of self-help intervention, subjects were invited to take part in a second evaluation. This postintervention survey consisted of the same questionnaires as the baseline survey, ending with questions subjectively appraising the allocated

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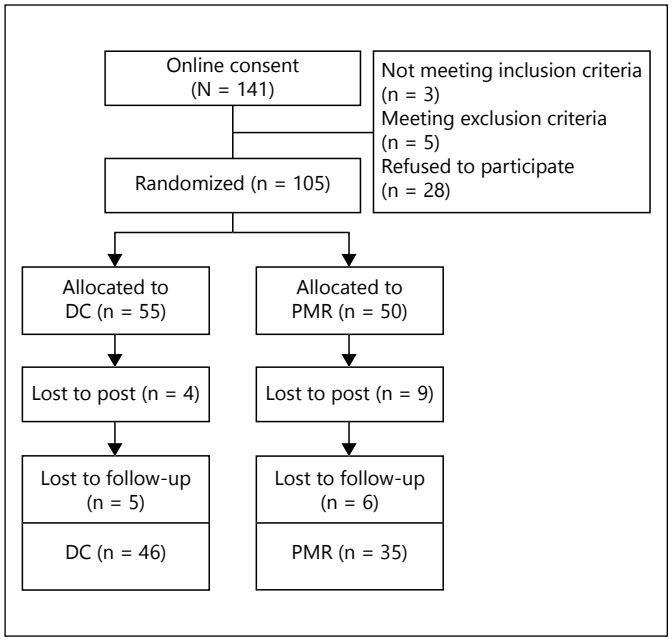

Fig. 1. CONSORT flow chart for inclusion, randomization, post-intervention phase and follow-up.

intervention. After 24 additional weeks, subjects were asked to complete the last survey and were contacted by phone for the 6-month follow-up interview.

Interventions: DC and PMR

Subjects were randomly allocated to either one of the two 4-week interventions, which were not described to them beforehand, neither in the study invitation nor during the telephone interview. Interviewers were blinded and did not know which manual each subject had received.

DC and PMR were described on 7- and 4-page pdf files, respectively, which were mailed to the participants after randomized allocation. Both files included written and illustrated psycho-educational introductions about TTM which overviewed its symptoms and potential somatic and social consequences. Afterwards, the rationale (what to do and why) was explained, followed by a description of the exercises and how to perform them.

DC aims to reshape an individual's self-harming, dysfunctional behaviour into behaviour(s) without hair-pulling, by decoupling the different behavioural elements of pulling (rationale). Subjects were asked to identify triggers for their hair-pulling behaviour and were instructed to redirect their movement from their hair to a target close to the pulling site (e.g. in the case of hair-pulling from the scalp, the new location might be their earlobe) or to redirect it externally into something in the room. Subsequently, they were instructed to manipulate one of the fingers they used in pulling to imitate the haptic experience gained from pulling or playing with their hair. Finally, they were instructed to redirect the stereotypic movement further. More detailed information about the instructions can be found in 'Movement decoupling: a self-help intervention for the treatment of trichotillomania' [24] or in the online manual (www.uke.de/impulskontrolle).

PMR served as an active control intervention, chosen as it is an established treatment for impulse control disorders, anxiety, depression and psychocutaneous disorders [33–35]. PMR is a relaxation technique commonly used in combination with HRT and follows standard instructions [36]. With PMR, it is possible to control stress, anxiety and depressive symptoms (rationale) that are common emotional states in people with TTM [9, 37].

E-Mail Support

During the online self-help intervention (4 weeks), subjects in both groups received weekly e-mail support. These e-mails were worded identically for both groups and encouraged subjects to actively practice the assigned intervention. During the follow-up period, participants received e-mails every other week. These e-mails did not encourage them to use the intervention, but were used to keep in touch.

After the follow-up telephone interview, subjects were informed by e-mail which intervention they had learned during the study and were provided with the alternative manual. Furthermore, they were provided with a voucher from a multimedia company which was valid internationally (150 CHF or the equivalent amount in euros).

Measures

Primary Outcome Variable

The German version of the Massachusetts General Hospital Hair-Pulling Scale (MGH-HPS) was administered to capture the severity of hair-pulling [38, 39]. The MGH-HPS is a 7-item self-report instrument. All items are rated on 5-point Likert scales ranging from 0 to 4, with higher scores indicating severer symptoms. The total score is the sum of all 7 items (range: 0–28). The instrument's internal consistency (0.89) and retest reliability (r = 0.97) are excellent [38, 40].

Secondary Outcome Variables

The World Health Organization Quality of Life Questionnaire was used to assess psychological quality of life [41]. This scale contains 6 items, each coded on a 5-point scale. The items can be summarized into psychological composite scores, with higher scores indicating better psychological quality of life. Internal consistency is satisfactory (r, range = 0.57–0.88) [42].

The SCL-K-9 [43], a short form of the Symptom Checklist SCL-90-R [44], was applied to assess general psychopathology. The SCL-K-9 is a 9-item questionnaire with an overall psychopathology index, the Global Severity Index (GSI), which can be calculated. All items are rated on a 5-point scale. The GSI represents the mean score of all items (range from 0 to 4, with higher scores indicating severe general psychopathology).

The Mini-International Neuropsychiatric Interview [45, 46] was used to assess comorbid psychiatric disorders over the phone. It is a short, structured diagnostic interview for DSM-IV axis I psychiatric disorders. It is a reliable and valid instrument that demonstrates good concordance with both the Structured Clinical Interview for DSM diagnoses and the WHO Composite International Diagnostic Interview for ICD-10 [47].

Subjective appraisal of the interventions was measured with questions, for example, on helpfulness and comprehensibility. These questions were primarily constructed during the pilot study [24]. Responses were given on a 4-point forced-choice Likert scale, with 2 positive (e.g. unequivocally yes, likely yes) and 2 negative

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Table 1. Baseline characteristics of subjects in both groups (n = 105)

	DC (n = 55)	PMR (n = 50)	p
Females, n (%)	52 (94.5)	48 (96)	0.99
Mean age ± SD, years	32.80±10.00	31.28±9.54	0.43
Mean DoS ± SD, years	20.69±10.75	17.92±9.51	0.17
Number of comorbid conditions	1.05	1.14	0.75
Mean MGH-HPS ± SD	17.76±4.72	18.04±5.30	0.78
Mean WHO-psychological ± SD	52.73±18.69	50.75±19.61	0.60
Mean GSI ± SD	1.57±0.79	1.58±0.83	0.98

DoS = Duration of symptoms; WHO-psychological = psychological subscale of the World Health Organization Quality of Life questionnaire.

response choices (e.g. likely no, unequivocally no). Overall satisfaction was rated on a 6-point forced-choice scale, with numbered items (from 1 to 6, with 1 meaning 'very good') comparable to common school marks. For all questions, participants who gave a positive response were pooled, as were those who answered negatively.

Sociodemographic and clinical data were obtained through structured questions about gender, age and duration of illness symptoms.

Statistical Analysis

Descriptive statistics were used to characterize participants in the DC and PMR groups. Differences in baseline characteristics between the DC and PMR groups were investigated with independent t tests for continuous variables and Pearson χ^2 analysis for categorical variables. To test the effects of each intervention, two types of analysis were conducted: intention-to-treat analysis with first observations carried forward and completer's analysis for which only subjects who completed all assessments were included. For both analyses, a general linear model with repeated measures and repeated contrasts was conducted for the dependent variables MGH-HPS, WHO-psychological and GSI. Group (DC, PMR) served as the between-subject variable, with time (before, after, follow-up) as the within-subject factor. A significant intervention effect was assumed for any significant interaction between group and time. Assumptions for all analyses with a general linear model with repeated measures were checked in terms of Box's test of equality of covariance matrices, Mauchly's test of sphericity and Levene's test of equality of error variances. All assumptions were met, with the exception of a significant Box's test for the MGH-HPS and a significant Mauchly's test for the GSI (intention-to-treat and completers' analysis) which was considered with a Greenhouse-Geisser correction. To determine effect sizes, a partial η^2 was calculated (≥0.01 small effect, ≥0.06 medium effect, and ≥0.14 large effect size) [48].

Results

Baseline

Table 1 summarizes the sociodemographic and psychopathological characteristics of the DC (n = 55) and PMR (n = 50) groups at baseline. There were no significant differences between the two groups in terms of any sociodemographic characteristic or any primary or secondary outcome.

The completion rate for follow-up was 77.1% (CONSORT chart diagram, fig. 1).

Intention-to-Treat Analyses (General Linear Model with Repeated Measures)

Primary Outcome Variables

For the MGH-HPS total score, the effect of time was highly significant ($F = 27.87$, $p < 0.001$, partial $\eta^2 = 0.21$). The factor group ($F = 1.17$, $p = 0.28$, partial $\eta^2 = 0.01$) and the interaction variable group × time ($F = 0.64$, $p = 0.52$, partial $\eta^2 < 0.01$) were not significant. Symptom severity (MGH-HPS) was significantly reduced between the pre- and post-treatment evaluations ($F = 45.29$, $p < 0.001$, partial $\eta^2 = 0.31$) and remained reduced at the 6-month follow-up ($F = 2.62$, $p = 0.11$, partial $\eta^2 = 0.03$; table 2; online suppl. fig. 1; for all online suppl. material, see www.karger.com/doi/10.1159/000431290).

Secondary Outcome Variables

Analyses of WHO-psychological scores demonstrated significant effects over time ($F = 10.83$, $p < 0.001$, partial $\eta^2 = 0.1$), but no significant effects for group ($F = 0.68$, $p = 0.41$, partial $\eta^2 < 0.01$) or the group × time interaction ($F = 0.36$, $p = 0.69$, partial $\eta^2 < 0.01$). Significance emerged from pre- to post-treatment values ($F = 12.39$, $p = 0.001$, partial $\eta^2 = 0.11$), indicating improved psychological quality of life. No significant changes were observed between the immediate post-treatment and 6-month follow-up assessments ($F = 0.90$, $p = 0.34$, partial $\eta^2 < 0.01$; table 2; online suppl. fig. 2).

In terms of GSI (SCL-K-9), we observed the same pattern. Time exhibited a significant effect ($F = 12.90$, $p < 0.001$, partial $\eta^2 = 0.11$), but group ($F = 0.21$, $p = 0.64$,

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Table 2. Results of the general linear models (repeated measures) for hair-pulling severity and secondary outcomes, on intent-to-treat analyses (n = 105)

	Baseline (I)		Post-treatment (II)		Follow-up (III)		Group	Time			Group × time		
	DC	PMR	DC	PMR	DC	PMR		I vs. II	II vs. III	I vs. III	I vs. II	II vs. III	I vs. III
MGH-HPS	17.76± 4.72	18.04± 5.30	13.33± 6.25	14.66± 5.69	14.18± 5.74	15.56± 6.50	0.28 (0.01)	*<0.001* (0.31)	0.11 (0.03)	*<0.001* (0.25)	0.37 (0.01)	0.97 (0.00)	0.30 (0.01)
WHO-psych.	52.73± 18.69	50.75± 19.61	57.42± 19.55	53.58± 21.28	58.18± 18.96	55.08± 19.75	0.41 (0.01)	*0.001* (0.11)	0.34 (0.01)	*<0.001* (0.18)	0.39 (0.01)	0.76 (0.001)	0.59 (0.00)
GSI	1.57± 0.79	1.58± 0.83	1.30± 0.83	1.35± 0.84	1.16± 0.84	1.30± 0.74	0.64 (0.002)	*0.001* (0.11)	0.23 (0.01)	*<0.001* (0.24)	0.78 (0.001)	0.53 (0.004)	0.25 (0.01)

Scores are indicated as means ± SD. For group, time and group × time, p values are given with partial η^2 values in parentheses; significant p values are italicized. DC group n = 55; PMR group n = 50; WHO-psych. = psychological subscale of the World Health Organization Quality of Life questionnaire.

Table 3. Subjective appraisal of DC and PMR after treatment

Item	DC (n = 51), %	PMR (n = 41), %	p value
Satisfaction rating between 1 and 3	75	54	0.02[a]
I would recommend this method to a friend	80	68	0.004[b]
I intend to use this method in the future	86	78	0.41[b]
This method is appropriate for self-administration	63	61	0.37[b]
My hair-pulling symptoms have decreased due to this method	82	61	0.013[b]
The manual was written in a comprehensible fashion	100	100	–
I would find this method more helpful in combination with psychotherapy	53	58	0.54[b]
I found this method more helpful than other self-help approaches	67	61	0.035[b]

Satisfaction rating: 6-point forced-choice scale ranging from 1 to 6, with 1 meaning 'very good'; all other questions: 4-point forced-choice Likert scale; numbers given are cumulative percentages of participants who rated the question positive.

[a] Fisher's exact test. [b] Pearson's χ^2 analysis.

partial $\eta^2 < 0.01$) and the group × time ($F = 0.53$, $p = 0.58$, partial $\eta^2 < 0.01$) interaction did not. GSI improved significantly from before to after treatment ($F = 12.39$, $p = 0.001$, partial $\eta^2 = 0.11$). From immediately after treatment to 6 months of follow-up ($F = 1.47$, $p = 0.23$, partial $\eta^2 = 0.01$), there was neither significant improvement nor any worsening of global psychopathological severity (table 2; online suppl. fig. 3).

Subjective Appraisal

Table 3 provides data on the subjects' subjective evaluation of both intervention methods (DC, PMR). Both manuals were rated as comprehensible and appropriate for self-administration. Roughly 50% in each group stated that the manual might be even more helpful in the context of face-to-face psychotherapy. Satisfaction with the method was greater for DC than for PMR, and significantly more in the DC group stated that they would recommend the method to a friend. In addition, significantly more in the DC group reported subjectively decreased hair-pulling after treatment and rated the method as more helpful than other self-help approaches.

Completer Analyses of Primary and Secondary Outcomes (General Linear Model with Repeated Measures)

Completer analyses for MGH-HPS demonstrated similar results as intention-to-treat analyses, with a significant effect of time but no significant effects of the group × time interaction. The WHO-psychological score improved significantly over time, but again there was no significant effect of the interaction group × time. Completer analyses for GSI also revealed the same effects as the

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intention-to-treat analyses. Once again, time had significant effects, while the group × time interaction did not (online suppl. table 1).

Internal Consistency

Internal consistency in this study was excellent for MGH-HPS (Cronbach's alpha pre: 0.87, post: 0.92, follow-up: 0.92), and very good for the SCL-K-9 (Cronbach's alpha pre: 0.83, post: 0.87, follow-up: 0.86) and WHO-psychological score (Cronbach's alpha pre: 0.83, post: 0.86, follow-up: 0.83).

Discussion

This randomized controlled study aimed to compare the effectiveness of two online self-help interventions – DC and PMR – in adults with trichotillomania. It was anticipated that DC would be more effective than PMR. A comparison of clinical status before versus immediately after treatment and 6 months of follow-up revealed significantly improved hair-pulling symptoms, as measured by the primary outcome measure, the MGH-HPS, as well as in the secondary outcome variables psychological health-related quality of life and global symptom severity. Contrary to our a priori hypothesis, we found no difference in efficacy between the two treatment strategies. This unexpected finding is supported by post-test power analyses for MGH-HPS, which revealed only small differences between the two groups and demonstrated that, to detect such small differences statistically, 320 subjects would have been necessary in each group. However, participants in the DC group were significantly more satisfied with the intervention they received.

Different explanations are possible for the lack of any detected superiority of DC over PMR. In contrast to the pilot study [24], in which only the DC manual included psycho-education about TTM, in the present study both groups received the same psycho-educational information. Hence, psycho-education might be an effective intervention in itself, potentially reducing small differences in effectiveness and leading to comparable results for DC and PMR. This explanation is in line with studies that have found psycho-education to mitigate depression and anxiety even without additional disease-specific interventions [49, 50]. In addition, it has been reported that short, unspecific psycho-educational interventions can reduce stress effectively [50].

Two further factors might have influenced the outcome in both groups positively, and at the same time levelled the differences between DC and PMR that were identified in the pilot study. First, e-mail support was provided in this study but not in the pilot study [24]. There is some evidence in the literature that supported online therapy and self-help interventions are superior (larger effect size) to unsupported online interventions [21, 28]. For instance, motivational e-mail support has been found to increase the effect of Internet-delivered self-help in individuals suffering from insomnia [27], and online intervention for depression is more effective if either therapist or administrative support is provided [28]. Such support seems to increase adherence, e.g. by motivating study participants to continue with the online intervention [26].

Second, there is evidence that diagnostic interviews may increase the efficacy of online interventions (e.g. for depression [51]). Such interviews, potentially levelling out differences between the two groups, were conducted in the current study, but not in the pilot study.

Taken together, psycho-education, e-mail support and diagnostic interviews might have eliminated small differences in effectiveness between DC and PMR. At the same time, the non-specific but significant effectiveness of these factors might explain the greater effect size observed in the current versus the pilot study (current partial $\eta^2 = 0.31$, pilot partial $\eta^2 = 0.16$).

In summary, the present results indicate a significant and lasting reduction in hair-pulling symptoms with both the DC and the PMR interventions. This being said, we cannot draw causal conclusions about whether either method alone is effective as an intervention for patients suffering from TTM. Other factors like psycho-education might have influenced the effectiveness of DC and PMR, and our results might be at least partially explained by artefactual effects like regression towards the mean, the natural course of disease, the Hawthorne effect or placebo effects. While we think that non-specific effects due to the natural course of TTM are unlikely because our participants had reported long-lasting symptoms of roughly 20 years, future studies should include some form of non-treated control group (e.g. patients randomly allocated to a waiting list) to help rule out confounding effects caused by any of the above-mentioned factors.

Overall, both online self-administered methods received positive subjective appraisals. This is particularly relevant when considering that TTM (like obsessive-compulsive disorder) is often a hidden disorder [16] and that affected individuals may avoid help and treatment for several years [11, 15]. Compared to the PMR group, significantly more individuals in the DC group were satisfied with the method, would recommend it to a friend,

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reported decreased hair-pulling symptoms and found the method to be more helpful than other self-help approaches. A possible reason for these differences might lie in the different strategies behind the two methods. While DC is a comprehensive technique that directly addresses the TTM symptoms with conscious training of a useful alternative movement, the indirect rationale of PMR might be less comprehensible to patients. In fact, despite subjective appraisals in favour of DC, PMR might be an effective intervention for patients with TTM (and is a component of HRT, the gold standard for the treatment of TTM). It is comprehensible, easy to learn, and potentially reduces stress, anxiety and tension [17, 52], all of which are clinically documented to increase the urge to pull hair.

As mentioned in the Introduction, from a clinical point of view there seem to be two major subtypes of hair-pulling behaviour that can be distinguished: automatic hair-pulling and focused hair-pulling [7, 8]. Focused pulling is intentional, goal-directed and assumed to be driven by anxiety and tension. Therefore, PMR, which enables patients to reduce their level of stress and tension, might be a particularly useful intervention for these patients. On the other hand, DC, which enables patients to self-monitor their behaviours and redirect their hair-pulling, might be more useful for patients with automatic pulling [9, 10]. The differential effects of online self-administered DC and PMR on these two patient subsets should be addressed by future studies. Overall, from a clinical point of view, because many patients report both automatic and focused pulling [11], a combination of both interventions might be the most helpful approach.

Some study limitations, in addition to the above-mentioned lack of controls, must be acknowledged. First, the overwhelming majority of our participants were women (DC = 94.5% and PMR = 96%). While it is well known that online research attracts significantly more women than men [9, 53], and that women with TTM are the majority of patients found in clinical settings [4–6], it is unclear whether our results can be applied to male patients. Second, samples drawn from Internet-based sources and using an Internet-based intervention might not be representative of all people suffering from TTM. However, there is evidence that Internet results/responses are not substantially different from those of face-to-face studies [54]. A third limiting factor could be that some participants might have already been familiar with the DC or PMR intervention, and therefore less motivated to participate actively. Therefore, the effects of one or both interventions could have been underestimated.

Despite these limitations, the present study has strengths that could help to distinguish well-designed Internet interventions [55]. For example, (a) a diagnosis was made with a structured interview by phone; (b) a comprehensive intervention was provided; (c) the intervention was user-friendly and not overly technical, and (d) support and a clear deadline for the duration of treatment were provided. Furthermore, drop-out rates during intervention and follow-up were generally low.

To conclude, in both groups, TTM symptoms decreased with large effect sizes and these effects were as significant at 6 months of follow-up as immediately after treatment. However, contrary to our a priori hypothesis, similar reductions in hair-pulling severity were identified for DC and PMR. Overall, our results suggest that even brief, supported, online self-help interventions have the potential to reduce hair-pulling symptoms in adults with TTM. While we feel it is unlikely that there were substantial influences of unspecific effects on our results, the results might at least be partially explained by some unspecific effects. Therefore, longitudinal studies with additional randomly assigned control groups (e.g. a waiting list) are warranted.

Acknowledgements

We would like to acknowledge funding support from the Gottfried and Julia Bangerter-Rhyner Foundation and from the Novartis Foundation for medical-biological research.

Disclosure Statement

Potential conflicts of interest and support and financial involvement over the previous 3 years, regardless of their potential relevance to the paper:

S.W.: grants from the Gottfried and Julia Bangerter-Rhyner Foundation, the Novartis Foundation for medical-biological research, the University of Zurich career development grant 'Filling the gap'.

R.K.: none.

A.K.: none.

A.B.B.: fellowship from the Swiss Foundation for Grants in Biology and Medicine and the Swiss National Science Foundation.

A.D.: grant from the University of Zurich 'Matching Fund' and from the Johnson Foundation.

S.M.: grants from the German Research Foundation, Federal Ministry of Education and Research and Federal Ministry of Health.

M.R.: Speaker honoraria from AstraZeneca and Lundbeck Institute; research grants from the Gottfried and Julia Bangerter-Rhyner Foundation and the Novartis Foundation for medical-biological research.

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